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ABSTRACT

Designed to provide easy access to information pertaining to science and technology, this data book provides indicators on: (1) funding for research and development; (2) human resources utilization and supply; and (3) international science and technology efforts. Graphs and charts are used to note research and development efforts from a nationwide perspective, with expenditures from federal, industrial, and academic sources illustrated. Comparative graphs on human resources provide data on employed scientists and engineers, employed doctorates, women in science and technology, racial minorities, and school retention rates. In addition, assessments of the supply of professionals in science and technology are presented by type and number of degrees awarded, and fulltime graduate students currently enrolled. Several international science and technology indicators are outlined, such as ratios of research and development to gross national product (by country), United States patents granted to United States and foreign inventors, data on United States trade balances in high technology, and United States scientific and technical publications as compared to world publications. Three pages list other Science Resources publications. (TW)

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Suggested Citation

Science and Technology Data Book (NSF 86-311) (Washington, D.C., 1986).

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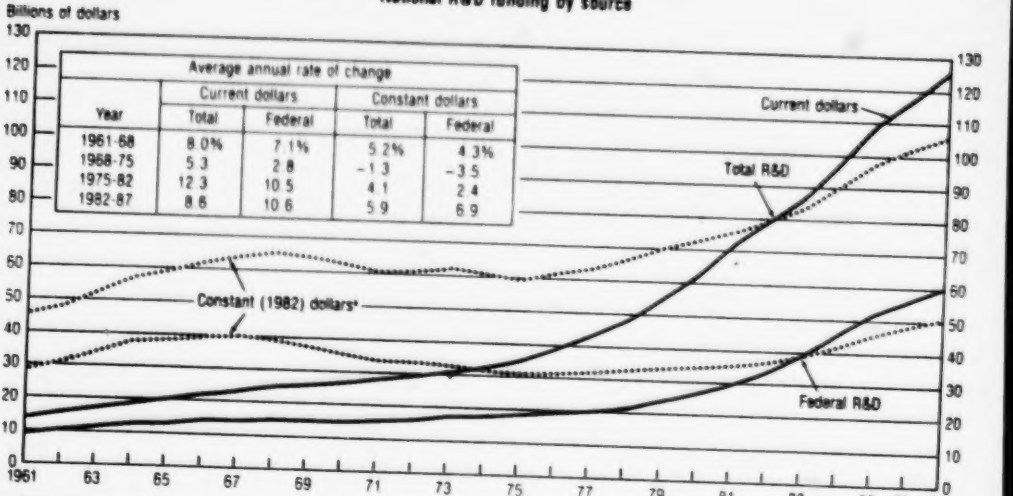
R&D FUNDING

R&D FUNDING

Figure 2

National R&D funding by source



Year	Average annual rate of change			
	Current dollars		Constant dollars	
	Total	Federal	Total	Federal
1961-68	8.0%	7.1%	5.2%	4.3%
1968-75	5.3	2.8	-1.3	-3.5
1975-82	12.3	10.5	4.1	2.4
1982-87	8.6	10.6	5.9	6.9

*Based on GNP implicit price deflator.

SOURCE: National Science Foundation

Additional data may be obtained from John R. Chinchello, SRS, Phone (202) 634-4625

Figure 3

National R&D funding by performer

[Dollars in millions]

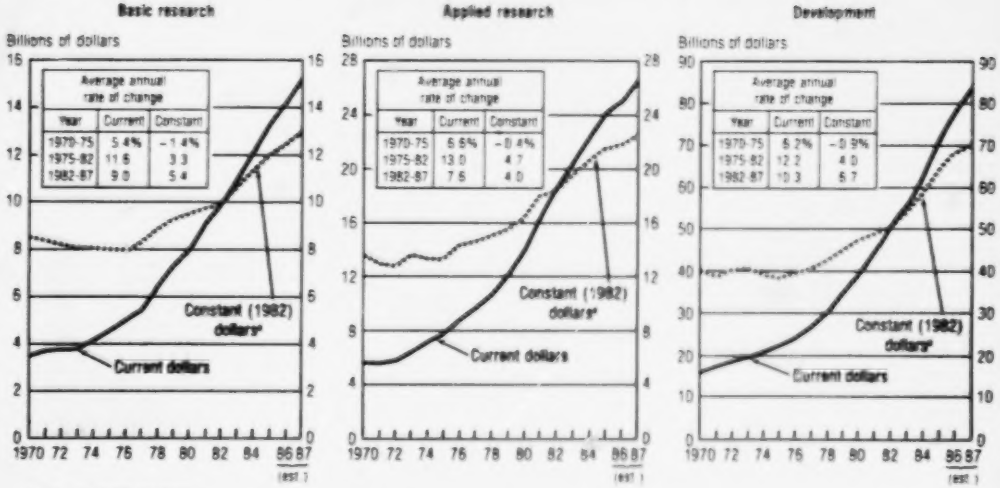
Year	Current dollars					Constant (1982) dollars[1]				
	Total	Federal Government	Industry	Universities / colleges	Other performers	Total	Federal Government	Industry	Universities / colleges	Other performers
1960	$ 13,523	$ 1,726	$10,509	$ 648	$ 642	$ 43,648	$ 5,548	$33,955	$2,077	$2,068
1968	24,605	3,494	17,429	2,149	1,533	65,458	9,395	46,194	5,778	4,090
1975	35,213	5,354	24,187	3,409	2,263	59,883	9,308	40,781	5,927	3,867
1982	79,318	9,141	57,995	7,276	4,904	79,318	9,141	57,995	7,276	4,904
1986 (est.)	117,500	13,525	86,225	10,600	7,150	102,350	11,750	75,100	9,250	6,250
1987 (est.)	125,200	15,400	91,050	11,100	7,650	105,725	13,000	76,900	9,375	6,450

Year	Average annual rate of change									
	Current dollars					Constant (1982) dollars[1]				
	Total	Federal Government	Industry	Universities / colleges	Other performers	Total	Federal Government	Industry	Universities / colleges	Other performers
1960-68	7.8%	9.2%	6.5%	16.2%	11.5%	5.2%	6.8%	3.9%	13.8%	8.9%
1968-75	5.3	6.3	4.8	6.8	5.7	−1.3	−.1	−1.8	.4	−.8
1975-82	12.3	7.9	13.3	11.4	11.7	4.1	−.3	5.2	3.0	3.5
1982-87	9.6	11.0	9.4	8.8	9.3	5.9	7.3	5.8	5.2	5.8

[1]Based on GNP implicit price deflator.
SOURCE: National Science Foundation.
Additional data may be obtained from: John R. Chrichetlo, SRS, Phone (202) 634-4825.

Figure 4

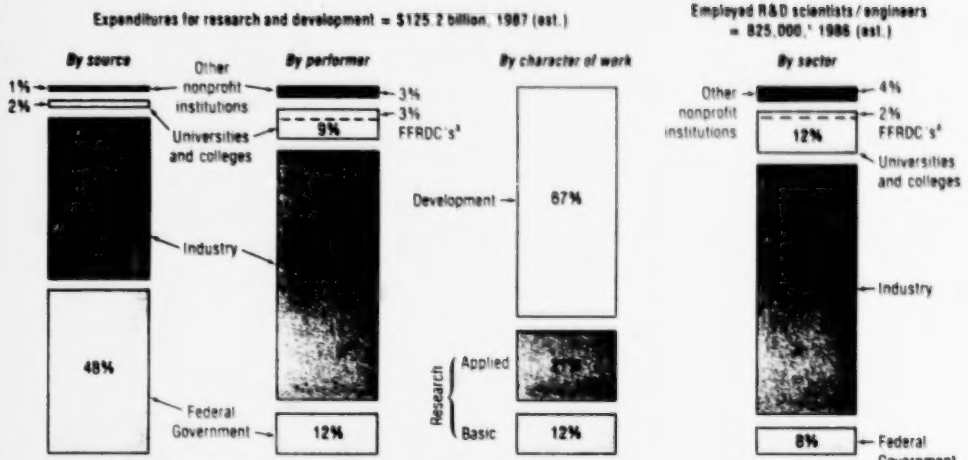
National R&D spending by character of work


Basic research
Billions of dollars
Average annual rate of change
Year | Current | Constant
1970-75 | 5.4% | -1.4%
1975-82 | 11.6 | 3.3
1982-87 | 9.0 | 5.4
Constant (1982) dollars*
Current dollars
1970 72 74 76 78 80 82 84 86 87 (est.)
Applied research
Billions of dollars
Average annual rate of change
Year | Current | Constant
1970-75 | 6.6% | -0.4%
1975-82 | 13.0 | 4.7
1982-87 | 7.5 | 4.0
Constant (1982) dollars*
Current dollars
1970 72 74 76 78 80 82 84 86 87 (est.)
Development
Billions of dollars
Average annual rate of change
Year | Current | Constant
1970-75 | 8.2% | -0.9%
1975-82 | 12.2 | 4.0
1982-87 | 10.3 | 5.7
Constant (1982) dollars*
Current dollars
1970 72 74 76 78 80 82 84 86 87 (est.)

*Based on GNP implicit price deflator
SOURCE: National Science Foundation
Additional data may be obtained from: John R. Chirichello, SRS, Phone: (202) 634-4625

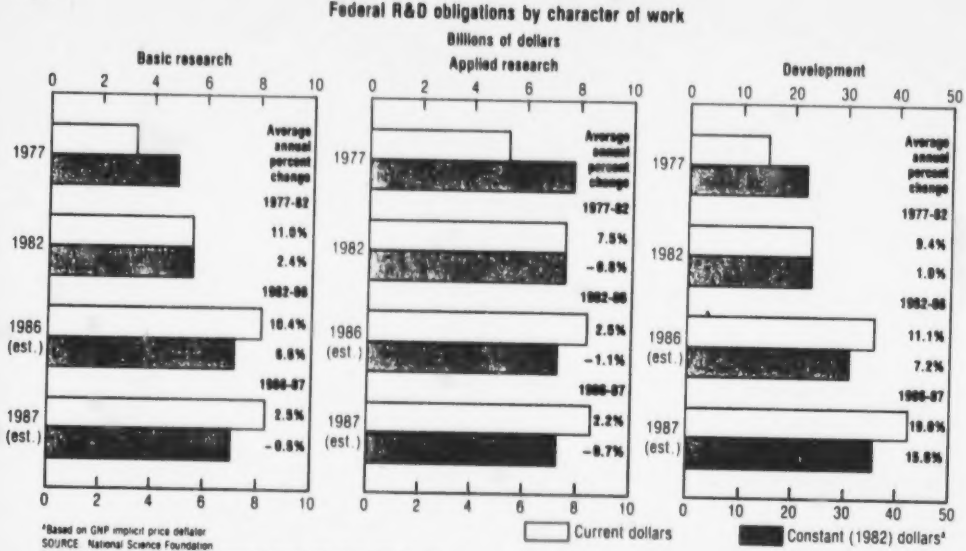
Figure 1

The national R&D effort



*Federally funded research and development centers administered by universities and colleges
†Full-time equivalents
SOURCE: National Science Foundation
Additional data may be obtained from: John R. Chiccheris, SRS, Phone: (202) 634-4825

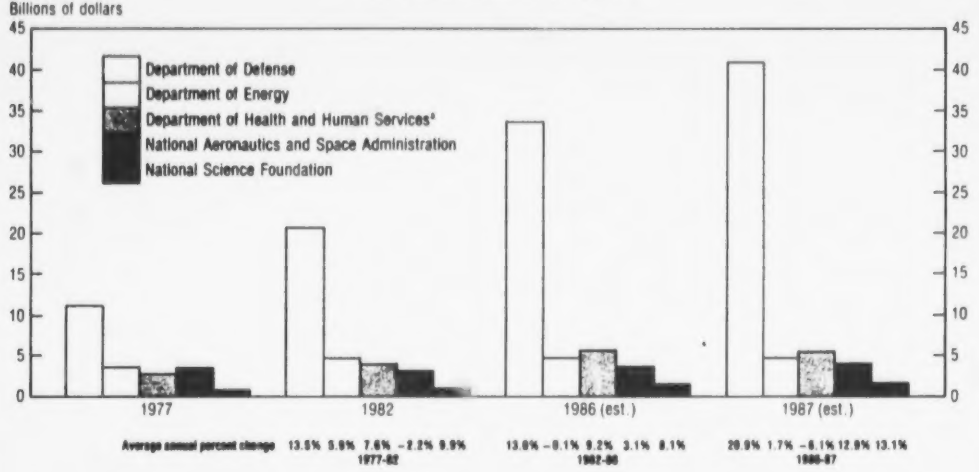
Figure 5



*Based on GNP implicit price deflator
SOURCE: National Science Foundation
Additional data may be obtained from: Margaret R. Grucza, SRS, Phone: (202) 634-4638

Figure 6

Federal R&D obligations by agency



*HEW in 1977 adjusted to reflect only health and human services programs (without education)
SOURCE: National Science Foundation
Additional data may be obtained from: Margaret R. Grucza, SRS. Phone: (202) 634-4638

Figure 7

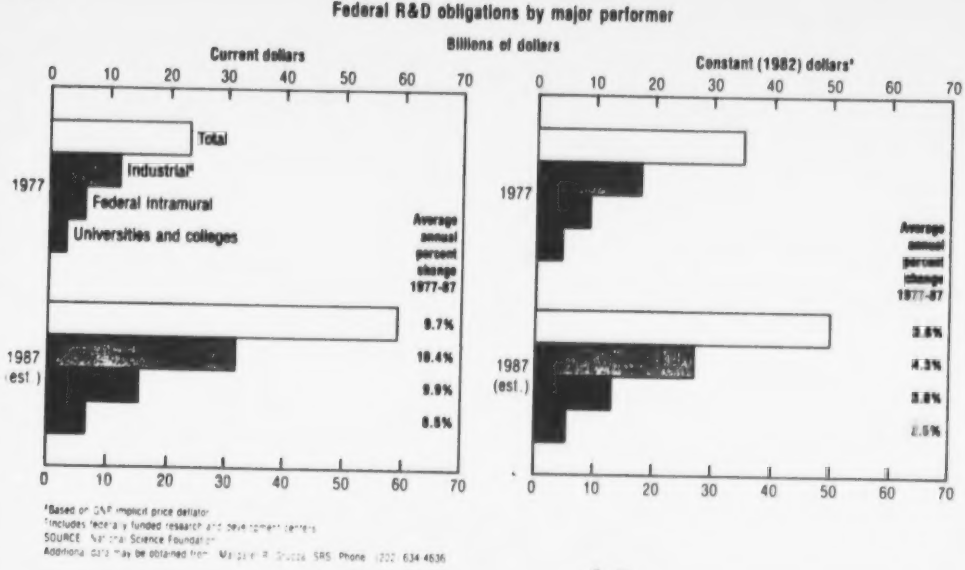
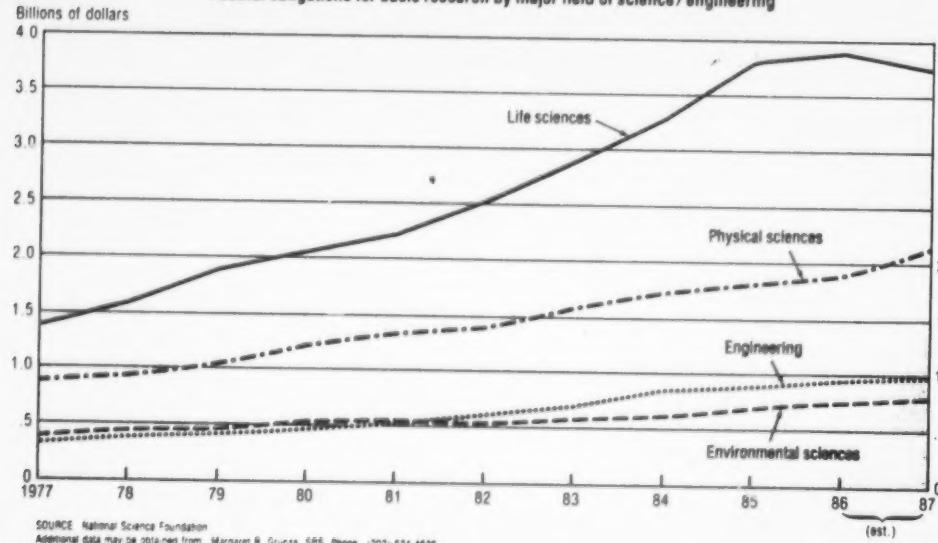

Federal R&D obligations by major performer
Billions of dollars
Current dollars
Constant (1982) dollars*
0 10 20 30 40 50 60 70
1977
1987 (est.)
Total
Industrial*
Federal intramural
Universities and colleges
Average annual percent change 1977-87
9.7%
10.4%
9.9%
8.8%
3.8%
4.3%
3.8%
2.8%
*Based on GNP implicit price deflator
Includes federally funded research and development centers
SOURCE: National Science Foundation
Additional data may be obtained from: Marianne P. Bruce, SRS, Phone (202) 634-4636

Figure 8

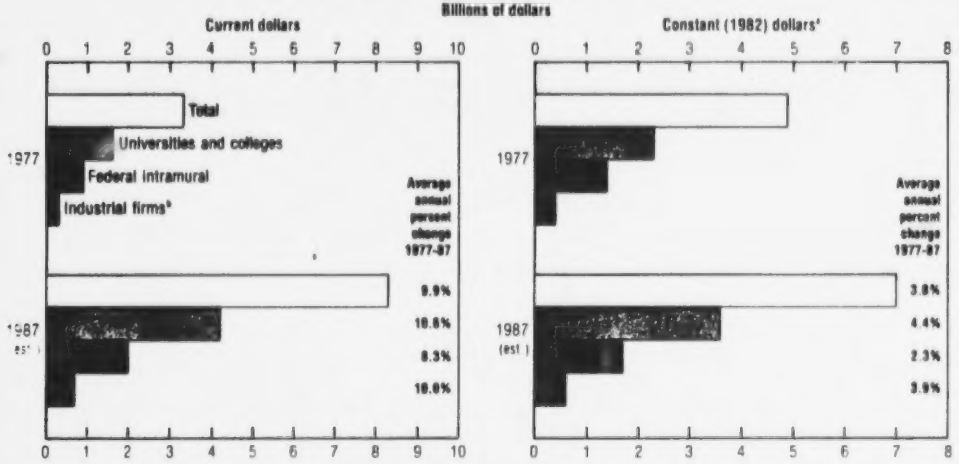
Federal obligations for basic research by major field of science / engineering



SOURCE: National Science Foundation
Additional data may be obtained from: Margaret R. Grucza, SRS, Phone: (202) 634-4638

Figure 9

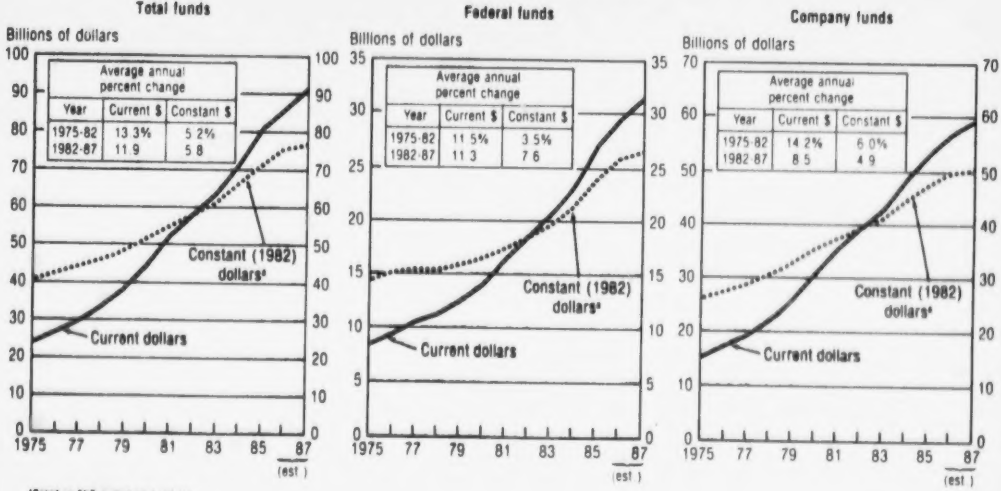
Federal obligations for basic research by major performer



[a]Based on GNP implicit price deflator.
[b]Includes federally funded research and development centers.
SOURCE: National Science Foundation.
Additional data may be obtained from: Margaret R. Grucza, SRS. Phone: (202) 634-4636.

Figure 10

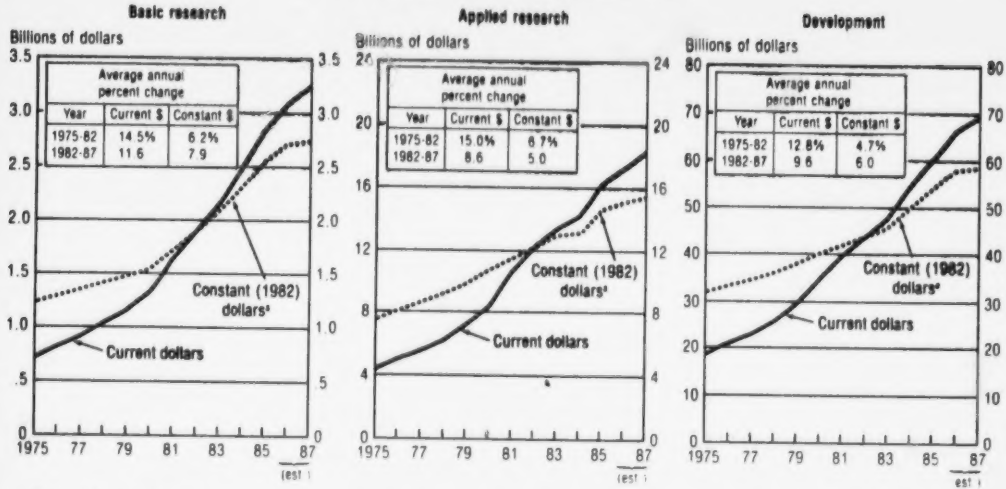
Industrial R&D expenditures by source of funds


Total funds
Billions of dollars
Average annual percent change
Year | Current $ | Constant $
1975-82 | 13.3% | 5.2%
1982-87 | 11.9 | 5.8
Constant (1982) dollars[a]
Current dollars
Federal funds
Billions of dollars
Average annual percent change
Year | Current $ | Constant $
1975-82 | 11.5% | 3.5%
1982-87 | 11.3 | 7.6
Constant (1982) dollars[a]
Current dollars
Company funds
Billions of dollars
Average annual percent change
Year | Current $ | Constant $
1975-82 | 14.2% | 6.0%
1982-87 | 8.5 | 4.9
Constant (1982) dollars[a]
Current dollars
1975 77 79 81 83 85 87 (est.)

[a]Based on GNP implicit price deflator
SOURCE: National Science Foundation
Additional data may be obtained from: Thomas J. Hogan, SRS. Phone: (202) 634-4648

Figure 11

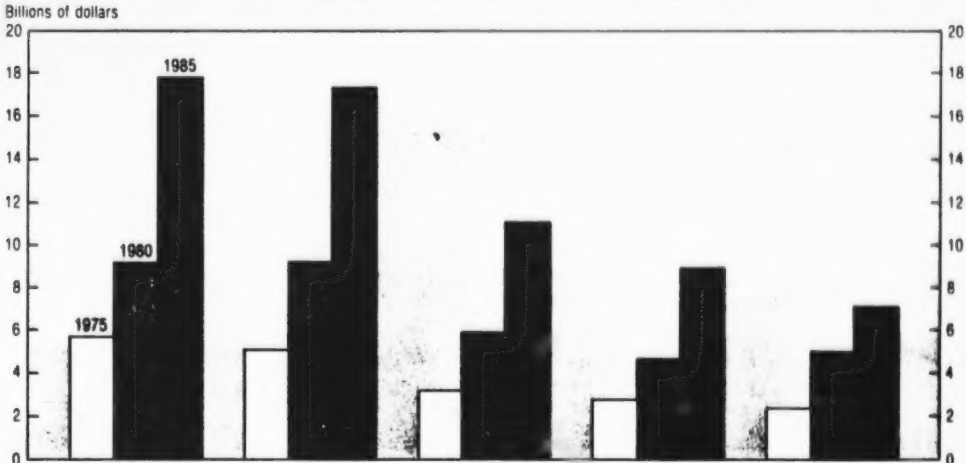
Industrial R&D expenditures by character of work


Basic research
Billions of dollars
Average annual percent change
Year | Current $ | Constant $
1975-82 | 14.5% | 6.2%
1982-87 | 11.6 | 7.9
Constant (1982) dollars[a]
Current dollars
1975 77 79 81 83 85 87 (est.)
Applied research
Billions of dollars
Average annual percent change
Year | Current $ | Constant $
1975-82 | 15.0% | 6.7%
1982-87 | 8.6 | 5.0
Constant (1982) dollars[a]
Current dollars
1975 77 79 81 83 85 87 (est.)
Development
Billions of dollars
Average annual percent change
Year | Current $ | Constant $
1975-82 | 12.8% | 4.7%
1982-87 | 9.6 | 6.0
Constant (1982) dollars[a]
Current dollars
1975 77 79 81 83 85 87 (est.)

[a]Based on GNP implicit price deflator.
SOURCE: National Science Foundation
Additional data may be obtained from: Thomas J. Hogan, SRS, Phone: (202) 634-4648

Figure 12

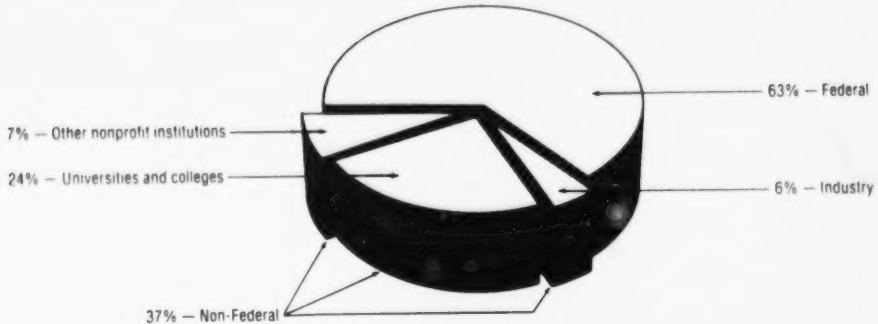
Total R&D expenditures and R&D/sales ratio of five leading industries



SOURCE: National Science Foundation
Additional data may be obtained from: Thomas J. Hogan, SRS. Phone: (202) 634-4648

Figure 13

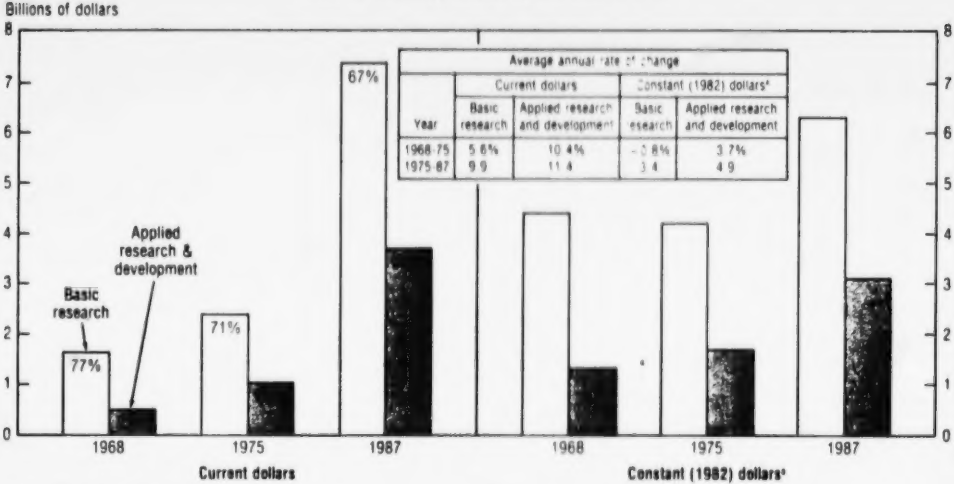
Academic R&D expenditures by source: FY 1987



NOTE: The Federal portion of academic R&D has ranged between 63 percent and 69 percent during the 1970-84 period.
SOURCE: National Science Foundation
Additional data may be obtained from: John R. Chinchello, SRS. Phone: (202) 634-4825

Figure 14

Academic R&D expenditures by character of work



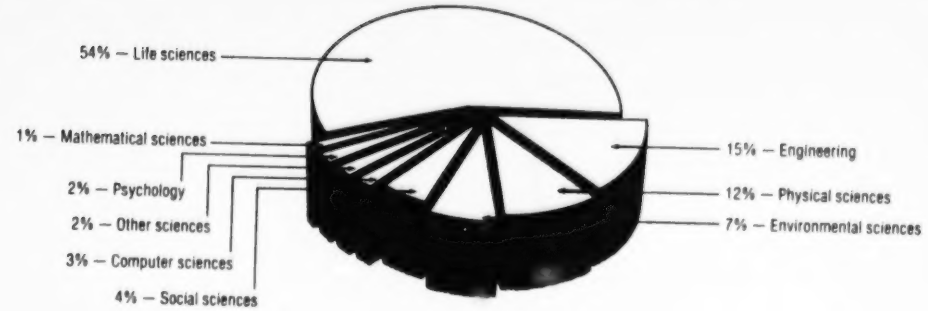
Year	Average annual rate of change: Current dollars, Basic research	Current dollars, Applied research and development	Constant (1982) dollars[a], Basic research	Constant (1982) dollars[a], Applied research and development
1968-75	5.6%	10.4%	-0.8%	3.7%
1975-87	9.9	11.4	3.4	4.9

[a]Based on GNP implicit price deflator
SOURCE: National Science Foundation
Additional data may be obtained from: John R. Chirichello, SRS, Phone: (202) 634-4825

Figure 15

Academic R&D expenditures by field: FY 1985

Total: $9.5 billion



NOTE: The distribution of academic R&D expenditures in FY 1988 was essentially the same as in FY 1985.
SOURCE: National Science Foundation.
Additional data may be obtained from: Penny D. Foster, SRS. Phone: (202) 634-4673.

Figure 16

Federal obligations to universities and colleges by type of activity[1]

[Dollars in millions]

Fiscal year[2]	Total obligations	Academic science/engineering					Non-science/engineering
		Total	Research and development[3]	R&D plant	Fellowships, traineeships, and training grants	All other	
1963	$1,413	$1,329	$830	$106	(4)	$393	$85
1967	3,318	2,324	1,301	111	447	464	994
1975	4,547	2,806	2,248	45	201	314	1,741
1980	8,298	4,790	4,160	38	210	383	3,508
1984	10,100	6,390	5,636	50	195	510	3,728
1985	11,000	7,260	6,379	114	255	513	3,724
Average annual rate of change (Current dollars)							
1963-67	23.8%	15.0%	11.9%	1.3%	NA	4.2%	85.2%
1967-75	4.0	2.4	7.1	−10.8	−9.5	−4.8	7.3
1975-80	12.8	11.3	13.1	−3.3	0.9	4.1	15.0
1980-85	5.8	8.7	8.9	24.7	3.9	6.0	1.2
(Constant 1982 dollars[5])							
1963-67	20.8%	12.2%	9.2%	−1.2%	NA	1.7%	80.7%
1967-75	−2.0	−3.5	.9	−15.8	−14.7	−10.2	1.1
1975-80	4.4	3.0	4.7	−10.8	−6.6	−3.7	6.4
1980-85	.03	2.8	3.0	17.9	−1.8	.3	−4.3

[1]Detail may not add to total because of rounding.

[2]Total obligations for the years 1981 through 1983 have been estimated by NSF based on revised data on student aid provided by the Department of Education.

[3]Academic research and development is estimated at $6.4 billion for 1986 and $6.5 billion for 1987. Separate data for the other components of academic science/engineering and non science/engineering are not available.

[4]Separate data were unavailable for this component before 1968. This total was imbedded within the total for "all other S/E activities" for the years 1963 through 1965.

[5]Based on GNP implicit price deflator.

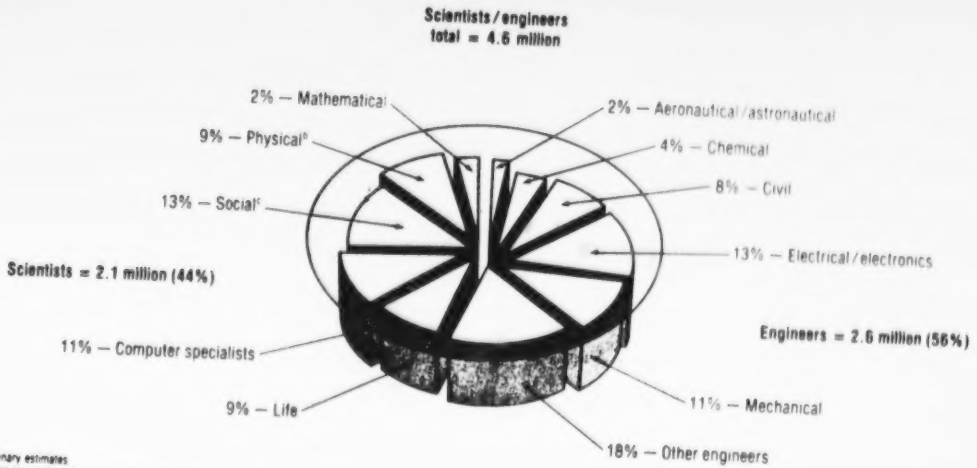
SOURCE: National Science Foundation.

Additional data may be obtained from: Margaret R Grucza, SRS, Phone: (202) 634-4638.

HUMAN RESOURCES

Figure 17

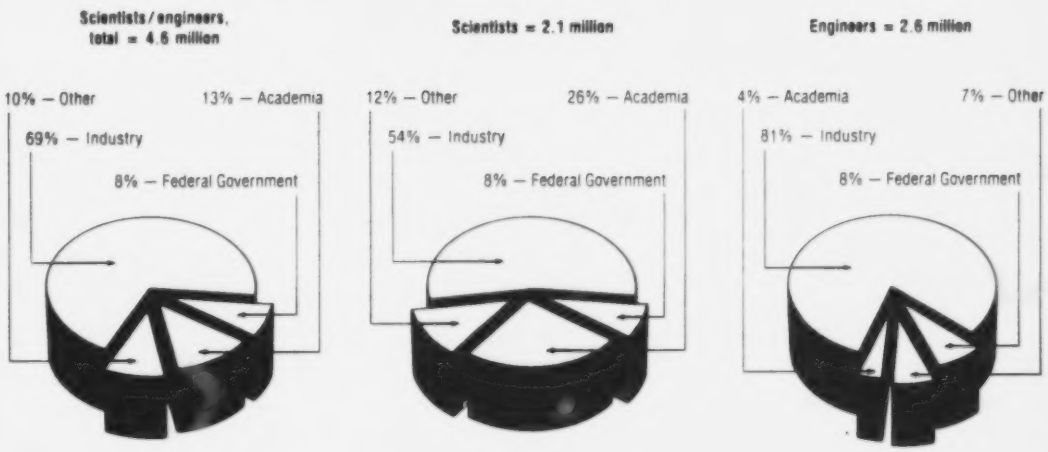
Employed scientists/engineers by field: 1986[a]



[a]Preliminary estimates
[b]Includes environmental scientists, 2 percent of total scientists and engineers
[c]Includes psychologists, 5 percent of total scientists and engineers
SOURCE: National Science Foundation
Additional data may be obtained from: Michael F. Crowley, SRS. Phone: (202) 634-4664

Figure 18

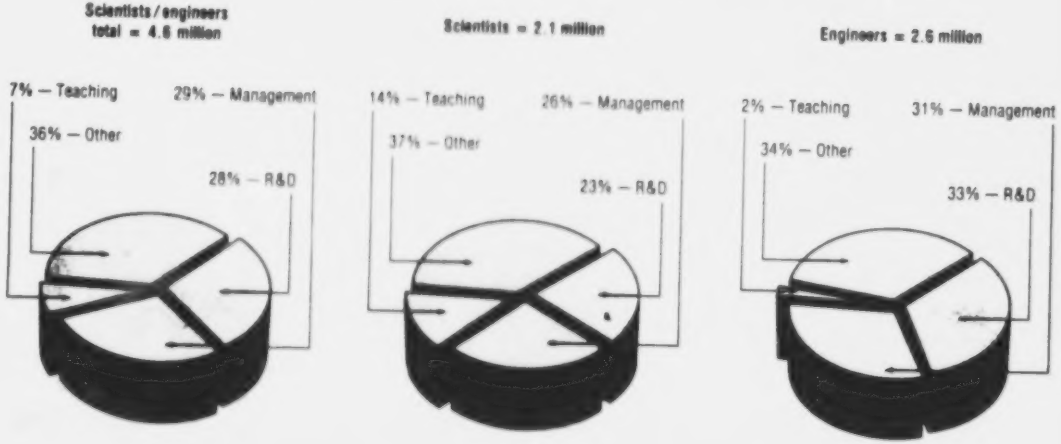
Employed scientists and engineers by sector: 1986*



*Preliminary estimates
SOURCE: National Science Foundation
Additional data may be obtained from: Michael F. Crowley, SRS. Phone: (202) 634-4684.

Figure 19

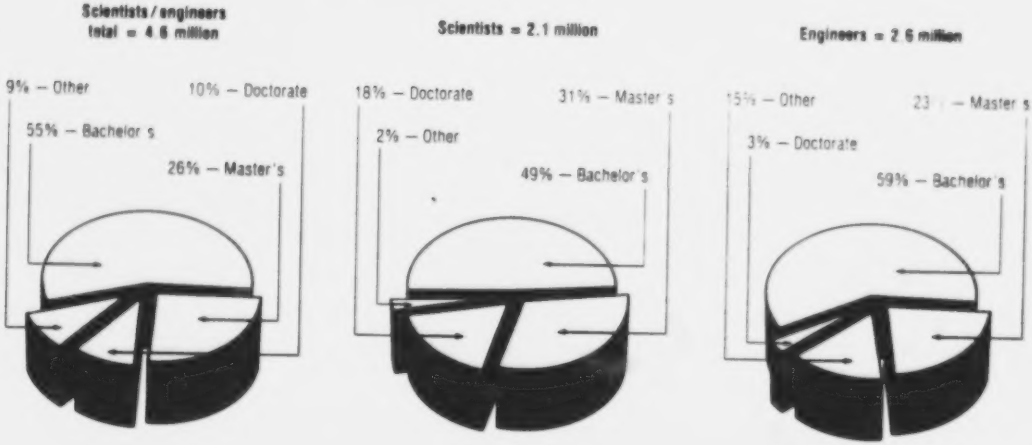
Employed scientists and engineers by primary work activity: 1986'



'Preliminary estimates
SOURCE: National Science Foundation
Additional data may be obtained from: Michael F. Crowley, SRS. Phone: (202) 634-4684

Figure 20

Employed scientists and engineers by highest degree: 1986[a]

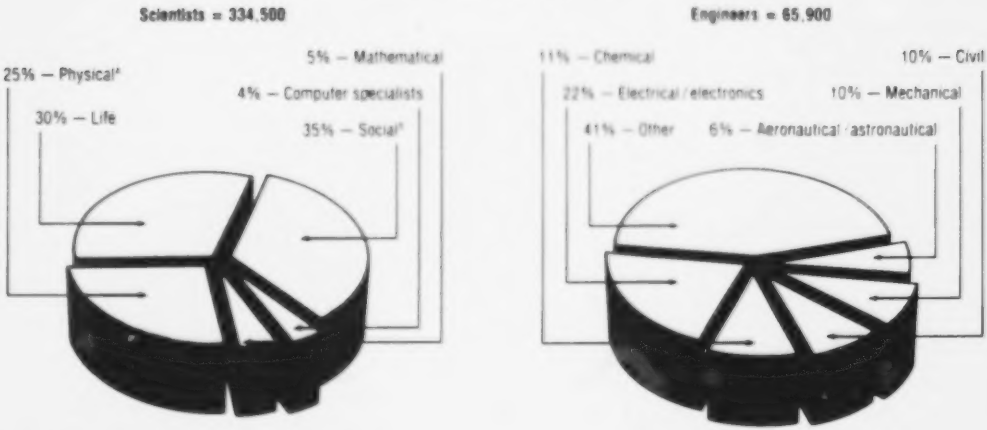


[a]Preliminary estimates.
NOTE: Total may not add to 100 because of rounding.
SOURCE: National Science Foundation
Additional data may be obtained from Michael F. Crowley, SRS. Phone (202) 634-4684

Figure 21

Employed doctorates in science and engineering by field: 1985

Scientists/engineers total = 400,400



*Includes environmental scientists, 5 percent of total scientists
†Includes psychologists, 16 percent of total scientists
NOTE: Total may not add to 100 because of rounding
SOURCE: National Science Foundation
Additional data may be obtained from Michael F. Crowley, SRS, Phone (202) 634-4664

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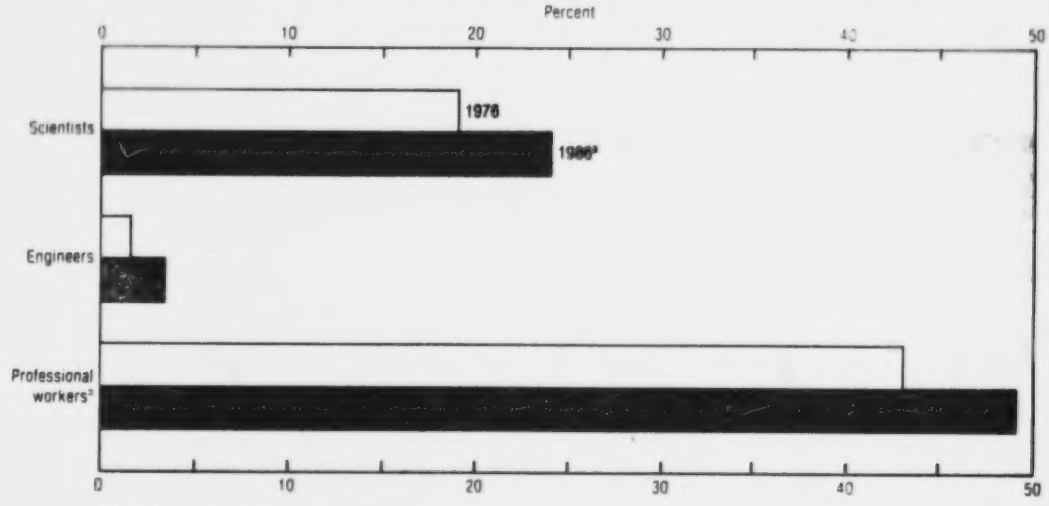
Figure 22

Women as a proportion of all employed scientists, engineers, and professional workers



*Preliminary estimates.
[2]Data represent 1976 and 1985.
SOURCES: National Science Foundation and Department of Labor.
Additional data may be obtained from: Michael F. Crowley, SRS, Phone: (202) 634-4684

Figure 23

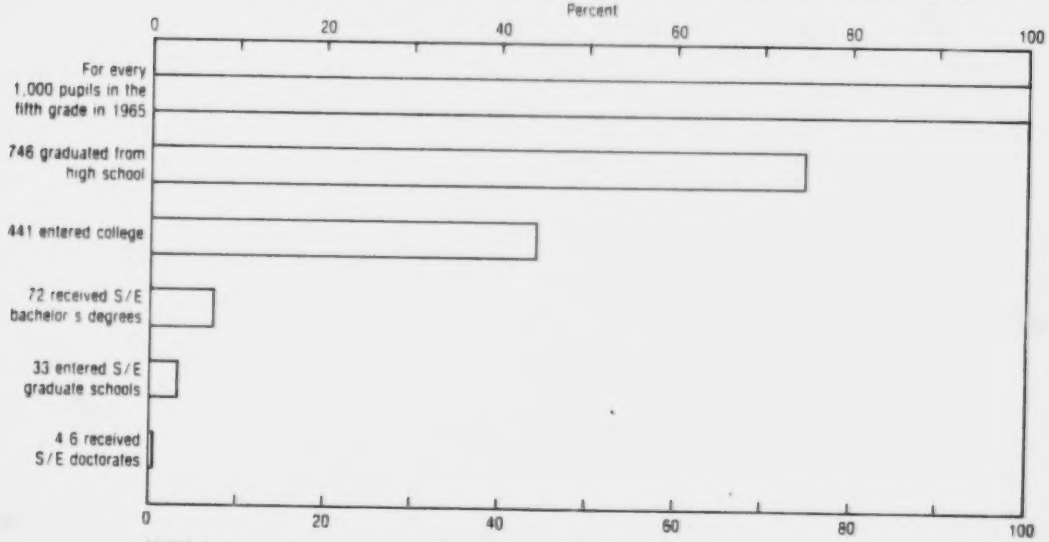
Racial minorities as a percent of technical work force

Technical work force	1976		1986[1]	
	Black	Asian	Black	Asian
	Percent of total	Percent of total	Percent of total	Percent of total
Professional workers[2]	NA	NA	6	NA
Total scientists and engineers	2	5	2	6
Scientists	2	5	3	3
Engineers	1	4	2	7

[1]Preliminary estimates
[2]Data are for 1985
NOTE: NA - not available
SOURCES: National Science Foundation and Department of Labor
Additional data may be obtained from: Michael F. Crowley, SRS, Phone: (202) 634-4664

Figure 24

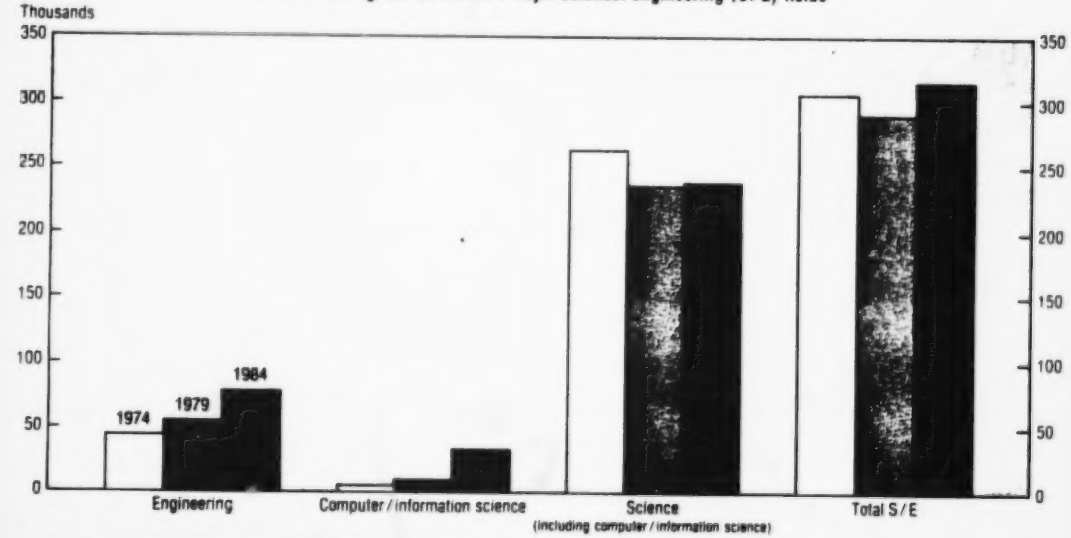
Retention rates, fifth grade through receipt of science/engineering (S/E) doctorate: 1965-85



SOURCES: Center for Statistics, Department of Education, National Academy of Sciences, and National Science Foundation.
Additional data may be obtained from: Mary A. Golladay, SRS. Phone: (202) 634-4787

Figure 25

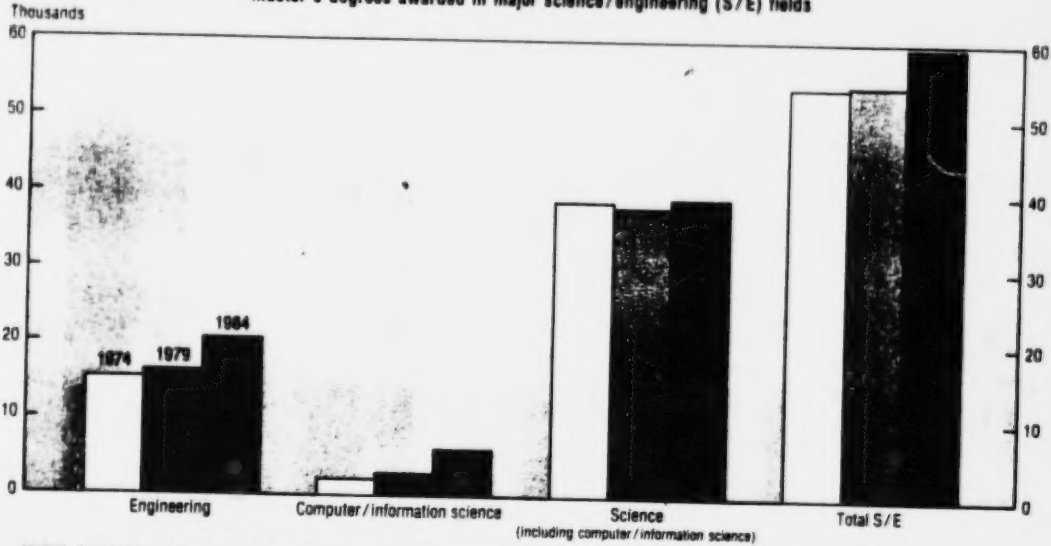
Bachelor's degrees awarded in major science/engineering (S/E) fields



SOURCES: Center for Statistics, Department of Education and National Science Foundation
Additional data may be obtained from: Mary A. Golladay, SRS. Phone: (202) 634-4787

Figure 2B

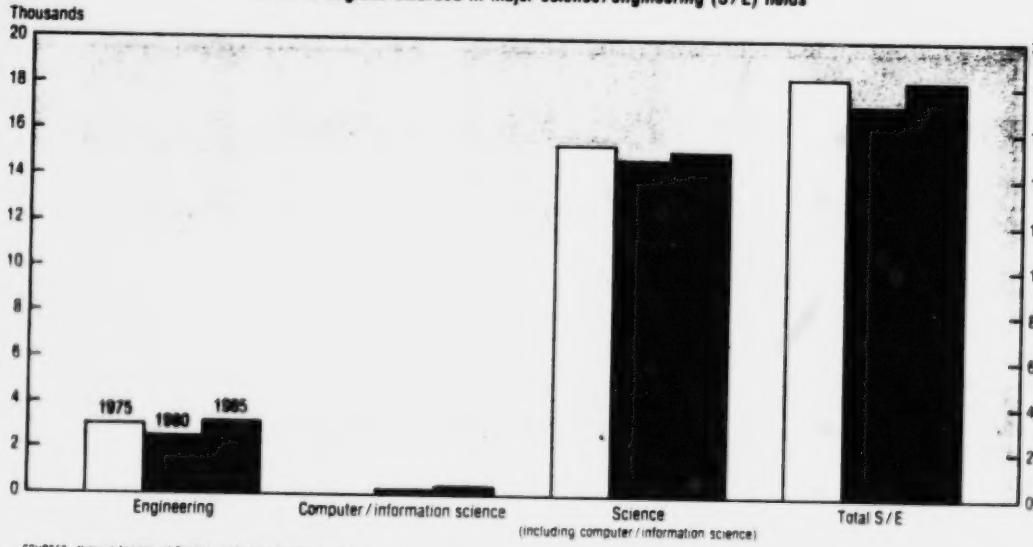
Master's degrees awarded in major science/engineering (S/E) fields



SOURCES: Center for Statistics, Department of Education and National Science Foundation
Additional data may be obtained from: Mary A. Golladay, SRS, Phone: (202) 634-4787

Figure 27

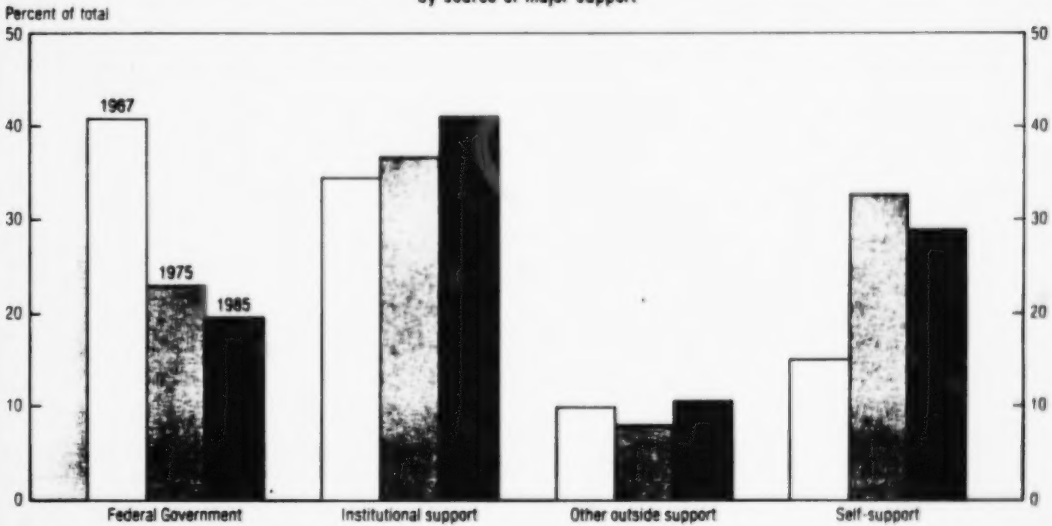
Doctor's degrees awarded in major science/engineering (S/E) fields



SOURCES: National Academy of Science and National Science Foundation
Additional data may be obtained from: Mary A. Golladay, SRS. Phone: (202) 634-4787

Figure 28

Full-time science/engineering graduate students in doctorate-granting institutions by source of major support



SOURCE: National Science Foundation
Additional data may be obtained from: Mary A. Golladay, SRS. Phone: (202) 634-4787

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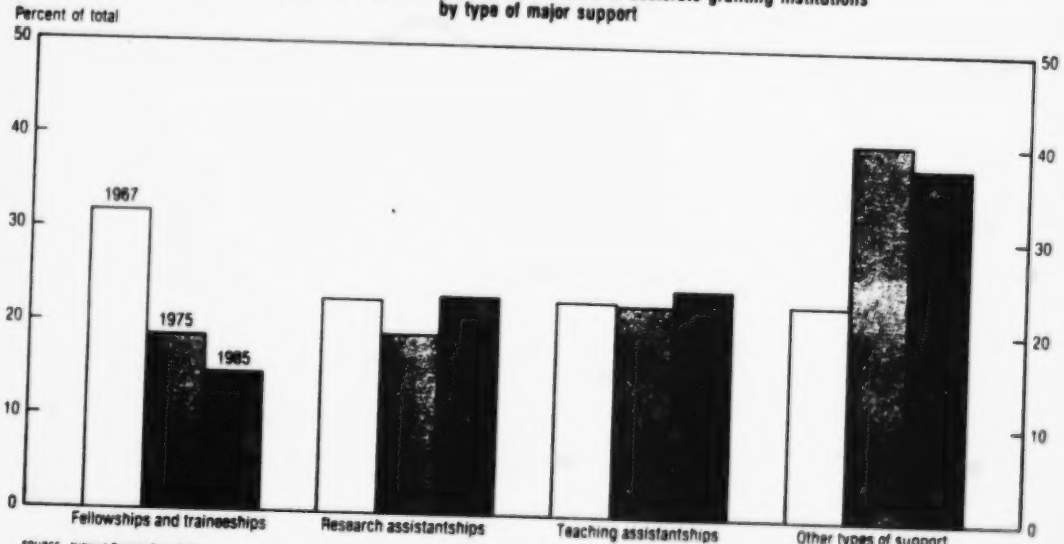
Figure 29

Full-time science/engineering graduate students in doctorate-granting institutions by type of major support



SOURCE: National Science Foundation
Additional data may be obtained from: Mary A. Golladay, SRS. Phone: (202) 634-4787

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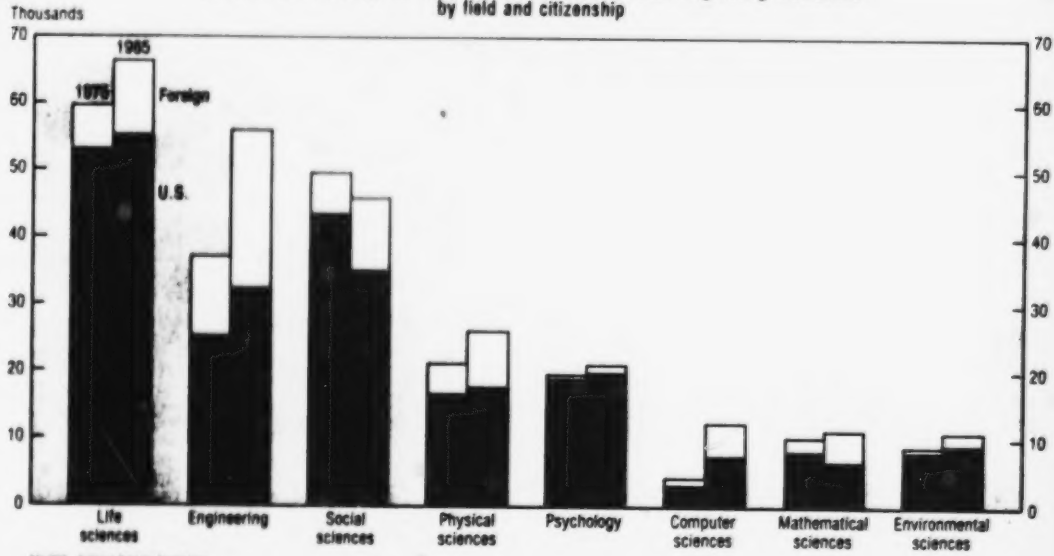
Figure 30

Full-time science/engineering graduate students in doctorate-granting institutions by field and citizenship



SOURCE: National Science Foundation

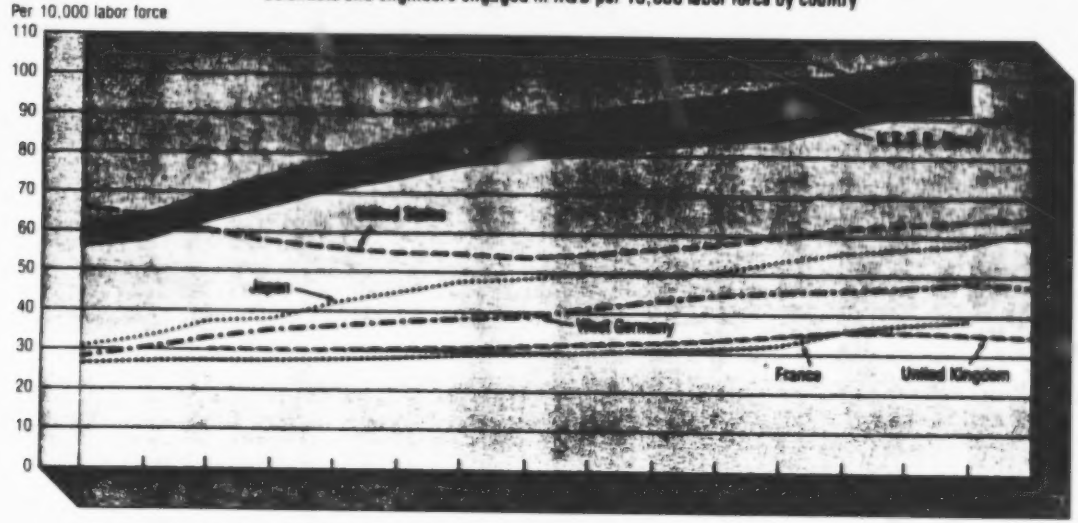
Additional data may be obtained from: Mary A. Golladay, SRS. Phone: (202) 634-4787

INTERNATIONAL S/T INDICATORS

INTERNATIONAL S/T INDICATORS

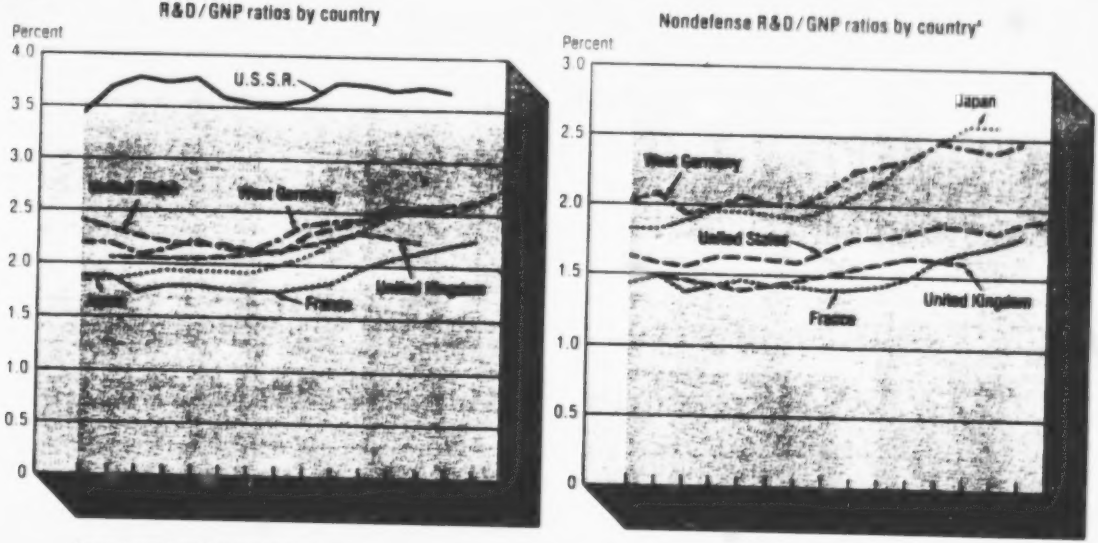
Figure 31

Scientists and engineers engaged in R&D per 10,000 labor force by country



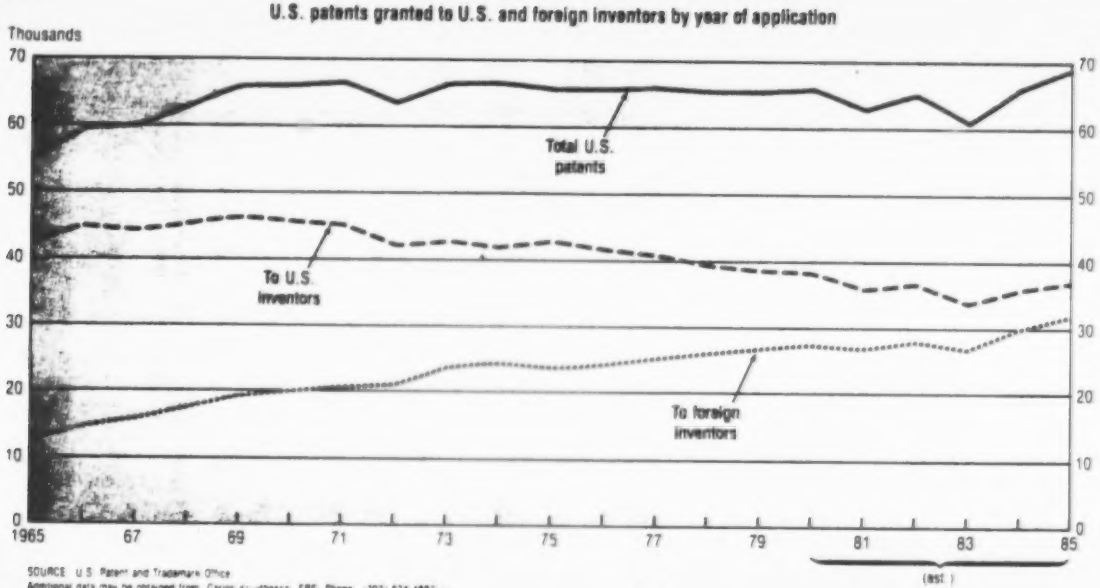
NOTE: A range has been provided for the U.S.S.R. because of the difficulties inherent in comparing Soviet scientific personnel data.
SOURCES: National Science Foundation, Organisation for Economic Co-operation and Development, and Dr. Robert Campbell (Indiana University).
Additional data may be obtained from: Carlos Kruytbosch, SRS. Phone: (202) 634-4682.

Figure 32



*Separate for nondefense R&D in the U.S.S.R. not available.
SOURCES: National Science Foundation and Organization for Economic Co-operation and Development.
Additional data may be obtained from: Carlos Kruytbosch, SRS, Phone: (202) 634-4682.

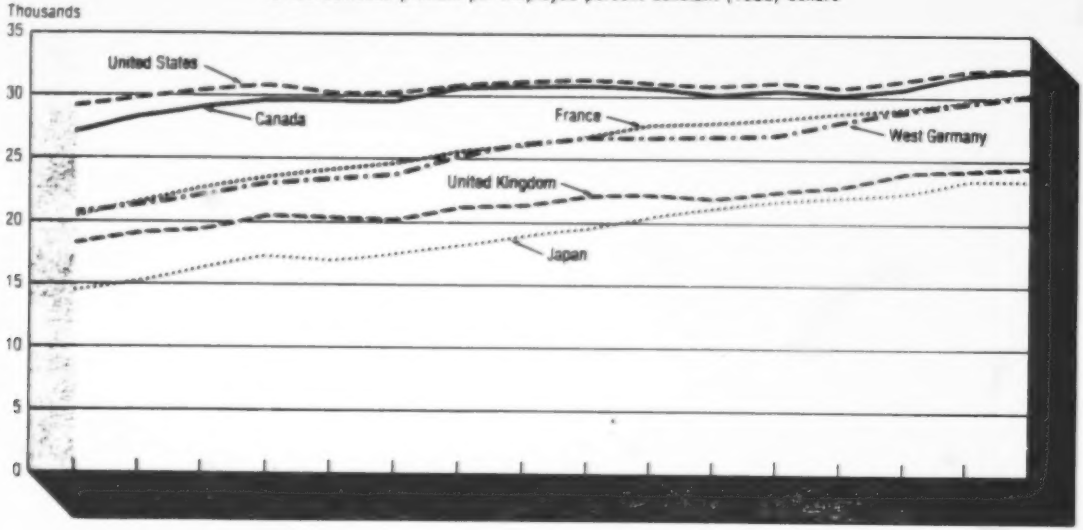
Figure 33



SOURCE: U.S. Patent and Trademark Office.
Additional data may be obtained from Carlos Kruytbosch, SRS. Phone: (202) 634-4882.

Figure 34

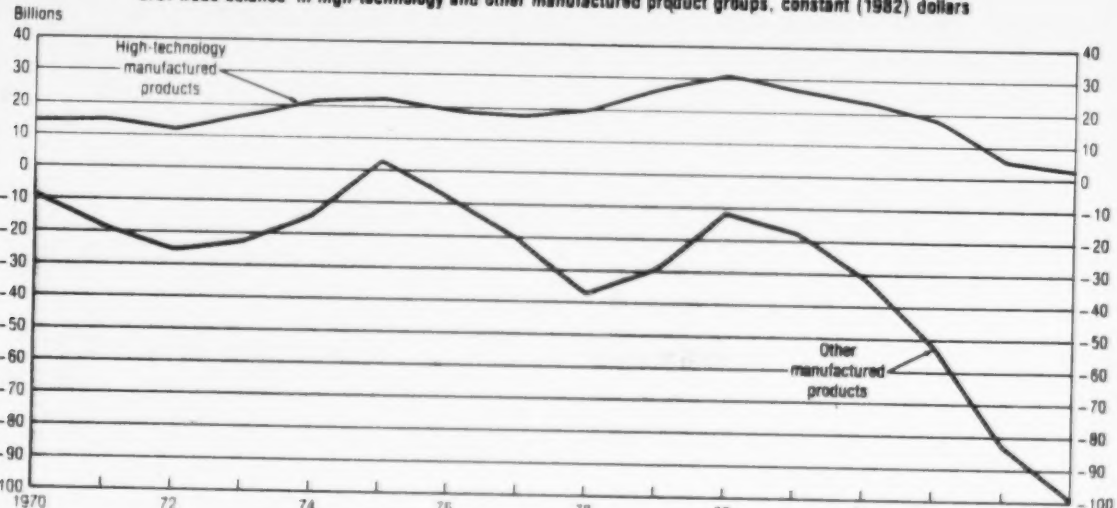
Gross domestic product per employed person, constant (1982) dollars



SOURCE: Bureau of Labor Statistics, Department of Labor
Additional data may be obtained from: Carlos Kruytbosch, SRS, Phone 202/ 634-4692

Figure 35

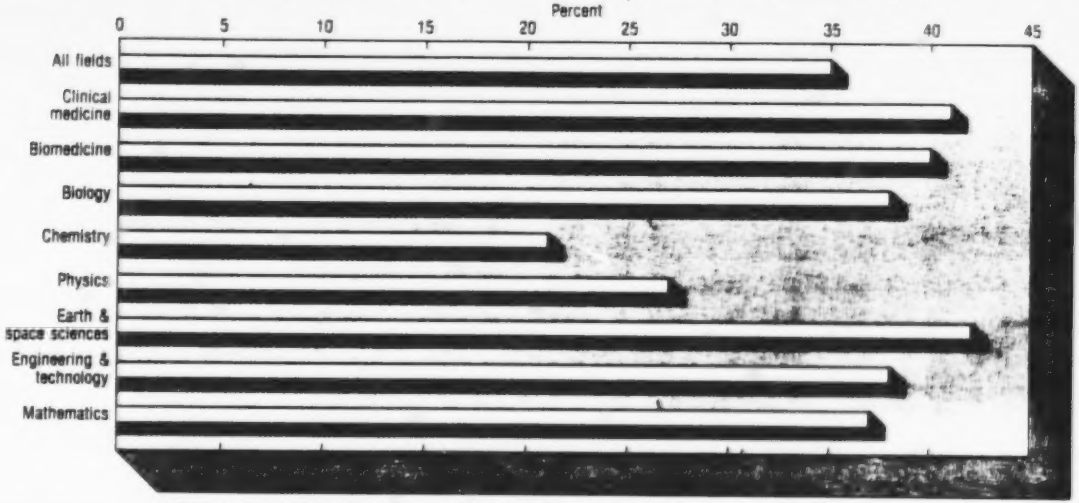
U.S. trade balance[1] in high-technology and other manufactured product groups, constant (1982) dollars



[1]Exports less imports.
SOURCE: Department of Commerce.
Additional data may be obtained from: Carlos Kruytbosch, SRS, Phone: (202) 634-4682.

Figure 36

U.S. scientific and technical (S/T) publications as a percent of world S/T publications: 1982



NOTE: These data are based on the articles, notes, and reviews in over 2,100 influential journals carried in the 1981 *Science Citation Index* of the Institute for Scientific Information. An article written by researchers from more than one country is prorated across the countries involved.

SOURCE: Computer Horizons, Inc.

Additional data may be obtained from: Carlos Kruytbosch, SRS. Phone: (202) 634-4682.

Other Science Resources Publications

Highlights

	NSF No.
R&D Funds	
"Defense Accounts for 75% of R&D Funds Proposed in President's 1987 Budget"	86-312
"8% Real Growth Projected Annually for Academic R&D Expenditures Through 1986"	86-302
"Defense Major Factor Behind Expected 7% Real Increase in 1986 National R&D Expenditures"	85-331
"9% Increase in Company-funded Research and Development Planned for 1986"	85-329
"Universities Report Research Equipment Shortages Are Most Severe in the Physical Sciences and Engineering"	85-320
"Federal Emphasis on Defense is Major Factor in 1983 Increase in Industrial R&D Performance"	85-318 (Rev.)
"Federal Academic R&D Funds Continue Strong Growth Through 1985"	85-314
S/E Personnel	
"Output of Science and Engineering Doctorates Stable in 1985, But Non-U.S. Citizens and Women Increase Their Shares of the Total"	86-308
"Graduate S/E Enrollment Shows Smallest Increase Since 1977"	86-303
"Survey of 300 U.S. Firms Finds One-Half Employ Foreign Scientists and Engineers"	85-336
"Science and Engineering (S/E) Graduates Find Increasing Opportunities for Employment in S/E Occupations"	85-334
"Scientific and Technical Employment in Manufacturing Reaches 1.5 Million in 1985"	85-330
"All Fields Share in 3% Growth in Academic S/E Employment"	85-317
"Shortages Increase for Engineering Personnel in Industry"	85-309
"Ph.D. Scientists and Engineers Shift to Industrial Employment and Related Activities"	85-301

Detailed Statistical Tables

	NSF No
R&D Funds	
Academic Science/Engineering: R&D Funds, Fiscal Year 1984	Unnumbered
Federal Funds for Research and Development: Fiscal Years 1984, 1985, and 1986, Volume XXXIV	Unnumbered
Federal Support to Universities, Colleges, and Selected Nonprofit Institutions: Fiscal Year 1984	Unnumbered
Research and Development in Industry: 1983	85-325
S/E Personnel	
Academic Science/Engineering: Graduate Enrollment and Support, Fall 1984	Unnumbered
Academic Science/Engineering: Scientists and Engineers, January 1985	Unnumbered
Characteristics of Doctoral Scientists and Engineers in the United States: 1985	Unnumbered
Characteristics of Recent Science/Engineering Graduates: 1984	Unnumbered
Federal Scientists and Engineers: 1985	Unnumbered
Immigrant Scientists and Engineers: 1985	Unnumbered
Science and Engineering Doctorates: 1960-84	Unnumbered
Scientists, Engineers, and Technicians in Manufacturing Industries: 1983	85-328
Scientists, Engineers, and Technicians in Nonmanufacturing Industries: 1984	Unnumbered
U.S. Scientists and Engineers: 1984	Unnumbered

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*Unnumbered Detailed Statistical Tables are obtainable on diskette

Reports

	NSF No
R&D Funds	
A Comparative Analysis of Information on National Industrial R&D Expenditures	83-311
Federal R&D Funding by Budget Function: Fiscal Years 1985-87	86-306
S/E Personnel	
Federal Scientific and Technical Workers: Numbers and Characteristics	85-312
The 1982 Postcensal Survey of Scientists and Engineers	84-330
Composite	
Academic Science/Engineering: 1972-83. R&D Funds, Federal Support, Scientists and Engineers, Graduate Enrollment and Support	84-322
National Patterns of Science and Technology Resources: 1986	86-309
Resources Supporting Scientific and Engineering Activities at Historically Black Colleges and Universities	84-332
Science and Engineering Personnel: A National Overview	86-302
Women and Minorities in Science and Engineering	86-301
International	
Comparison of Scientific and Technical Personnel Trends in the United States, France, West Germany, and the United Kingdom Since 1970	84-335
International Science and Technology Data Update: 1986	86-307
The Science and Technology Resources of West Germany: A Comparison with the United States	86-310
Science Indicators: The 1985 Report	NSB 85-1
Bibliography	
Project Summaries: FY 1986	86-313
Publications List: 1976-86	In press